The Role of Point of Care Testing in Intensive Care

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The information presented in the following slides is specific to my experience and the *i-STAT system*.

My experience may differ from other users with the same system in place.
N.Y Methodist CTICU

• 8-bed Cardiac Surgery Intensive Care Unit
• Open Heart Surgery, Thoracic Surgery and Robotic Surgery patients
• ECMO and Ventricular Assist Devices Performed in Intensive Care Unit
• Aortic Dissection and Aneurysm Surgery patients treated exclusively in the Cardiac Surgery ICU
• Point of Care Testing utilized extensively for over 7 years in all ICU’s including recovery room and step-down units
LEAPFROG Initiative

Established in January 2000 by the Business Roundtable (BRT) in response to the Institute of Medicine report on quality and safety of medical care

• The BRT is composed of Chief Executive Officers of U.S. corporations representing more than 28 million employees. Leapfrog has proposed hospital safety measures:
  – ICU Physician Staffing (IPS): Staffing ICUs with doctors who have special training in critical care medicine, called ‘Intensivists’ has been shown to reduce the risk of patients dying in the ICU by 40%
• As more and more hospitals recognize the value of Intensivist-led intensive care units, the demand for these specialists has increased
• A recent study found that fewer than 6,000 Intensivists are in active practice in the United States
• At the same time, less than 15% of ICUs had dedicated Intensivists, and those without had little hope of hiring Intensivists from the limited pool available
• Hospitals with Intensivists also often have shorter lengths of stay in the critical care unit and a smaller number of unnecessary critical care admissions

Source: COMPACCS Study, JAMA, 2000; 284:2762
Source: Leapfrog Group ICU Fact Sheet: http://leapfroggroup.org/FactSheets/ICU_FactSheet.pdf
CTICU POCT Integration

POINT OF CARE TESTING INTEGRATION

PLATELET AGGREGATION STUDIES & BLOOD UTILIZATION

INTEGRATION WITH PHARMACY

RESPIRATORY WEANING PROTOCOLS & POINT OF CARE TESTING
Point of Care Testing (POCT) in the ICU

CTICU and PACU

• **Weaning Protocol** - for ABG analysis hourly for 18 hours immediately post-operatively

• **Post Operative Hemorrhage Etiology Analysis** - utilizing the PT/INR cartridge.
  • Tests upon arrival of the patient from the OR, and every 4 hours thereafter.

• **Blood Utilization Requirements** - using the hematocrit results from the CG8+ cartridge.
  • Hourly hematocrit results are integrated into transfusion requirements perioperatively. This has lead to a significant reduction in blood utilization requirements.

• **Ionized Calcium Determinations** - This is followed for the first 8 hours immediately post-op due to its impact on improving vasomotor tone and reducing hemodynamic pressure requirements
  • The impact of this is benchmarked by following Swan-Ganz data
POCT Implementers

POCT is implemented at the beside in the various ICU’s by the following clinical personnel:

• **Intensivists**: Intensivists staff the cardiac surgery, surgical and medical intensive care units as well as the recovery units

• **Anesthesiologists**: Involves Cardiac Anesthesiologists in open heart surgery and General Anesthesiologists utilizing the cartridges intra-operatively, specifically the CG8+ and PT/INR cartridges

• **Cardiac Surgery Perfusionists**: Heavy reliance on the CG8+ cartridges during all open heart surgery is required for the bypass pump

• **Respiratory Therapists**: Ventilatory management protocols in the CTICU integrate respiratory therapists clinical decision making with the ventilator, making prime use of the CG8+ cartridge

• **CCRN’s**: Independent hourly clinical decision making at the bedside allows the Critical Care RN’s to POCT

There is an obvious interplay between all who utilize POCT
Critical Care Flow Quality
24-Hour Satellite Pharmacy Services

Critical Care Patient Units

Cardio-thoracic ICU
Cardio-thoracic Stepdown (2017)
Coronary Care Unit
Pediatric ICU
Pediatric Floor
Nursery
Neonatal ICU

Procedural Areas

Main Operating Room
Endoscopy
Pre-Surgical Testing
Labor & Delivery Operating Room
Ambulatory Operating Room
Main Recovery Room
Resource Utilization

- L&D OR
- Neonatal ICU
- Pediatric ICU
- Coronary Care Unit
- PCI / Cath Lab
- Emergency Room
- Cardio-thoracic ICU
- Cardio-thoracic Step Down
- Medical ICU
- Medical Step Down / Infill 7
- Surgical ICU
- Surgical Step Down
- Recovery Room
- Main OR
- Cardio-thoracic ICU
- Medical ICU
- Surgical ICU
- Neurology Step Down
- Floor

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Impact of POCT in the ICU Setting

• Shortened Extubation Times*
• Reduced Length of Stay**
• Reduced Cost of Medical Services Provided**
• Reduced Resource Utilization of Respiratory Services*

*Source: Low Extubation Times in Cardiac Surgery Patients: Chest 2005 Oribabor et al
**Source: N.Y Methodist Cardiac Surgery 2010 Program Outcomes: N.Y. State Data
In order to reduce weaning times in open heart surgery, a study was undertaken with the following specific goals:

1. Assess the impact of POCT utilizing the CG8+ cartridge on integrating the respiratory weaning protocol

2. Assess the impact of bedside use of the CG8+ by Respiratory Therapists on respiratory staffing

3. Assess the impact of an integrated weaning protocol utilizing the CG8+ cartridges on ventilator equipment utilization
i-STAT System: Intended Use Information

- PT/INR
  - The i-STAT PT, a prothrombin time test, is useful for monitoring patients receiving oral anticoagulation therapy such as Coumadin or warfarin.
**PURPOSE:** To utilize the Rapid Shallow Breathing Index (RSBI) to lower extubation times in open heart surgery patients.

- CG8+ Cartridges and PT/INR cartridges were utilized
- The PT/INR cartridges were utilized to objectively coagulation disorders post-operatively, which then served as an EXCLUSION CRITERIA to extubation
- The results from this were incorporated into the extubation halting criteria

The results shown here are specific to one healthcare facility and may differ from those achieved by other institutions
Methods

- 167 open heart surgery patients prospectively studied between April 1, 2004 and March 30, 2005
- Included 33 valve surgery patients
- 122 coronary artery bypass graft (CABG)
- 5 Stanford A Aneurysm patients
- 1 aortic dissection
- 1 combined valve/aneurysm patient
- 4 off-pump CABG patients
- 1 pericardial stripping
- No patients were excluded
- EXTUBATION CRITERIA: Rapid shallow breathing index105

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Methods (cont’d)

• EXTUBATION HALTING CRITERIA:
  – Medisatinal Hemorrhage 200cc/hour
  – Ramsay Sedation scale 4
  – Metabolic or respiratory acidosis on continuous positive airway ventilation
  – Postoperative cardiogenic shock

• EXTUBATION TIME: defined as time from arrival in the intensive care unit to time extubated

The results shown here are specific to one healthcare facility and may differ from those achieved by other institutions
Methods (cont’d)

• REINTUBATION:
  – Defined as any patient reintubated within 24 hours of extubation
  – Narcotic analgesia with morphine was used for postoperative pain
  – The patients’ cardiac anesthesiologists were informed of the weaning criteria with the RSBI that was going to be used
  – Drager Ventilators (model EVITA XL, which calculate and display the RSBI continuously) were used
  – All patients were placed in a semi recumbent position once the immediate postoperative blood samples had been taken
  – The head of the bed was raised to at least 45 degrees
  – Patients with intra-aortic balloon pumps were placed in a reversed trendelenburg position for weaning
  – Bedside physical therapy with incentive spirometers was commenced immediately post-extubation

The results shown here are specific to one healthcare facility and may differ from those achieved by other institutions
Results

• The overall mean extubation time was 2 hours and 40 minutes
• The mean extubation time was unaffected by outliers who did not meet the weaning criteria for extubation
• This included a total of 6 patients who remained intubated for 18 hours
• Zero reintubations
• Overall mean extubation times were unaffected by the age, hemodynamic status, comorbidity, or ejection fraction

The results shown here are specific to one healthcare facility and may differ from those achieved by other institutions.
Conclusion

• The utilization of the rapid shallow breathing index as the sole criteria for weaning has lead to significantly low mean extubation times in cardiac surgery patients

• No increased rates of reintubation were observed

• Postoperative narcotic analgesia did not increase mean extubation times

• CG8+ and PT/INR Cartridges were used exclusively in this study
Clinical Implications

• Significant reductions in resource utilization of the respiratory department and ventilator equipment.
• Patient and family satisfaction at early extubation times.
• Reduced length of stay in the intensive care unit.

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Early Extubation 2009

Exclusion Criteria; Re-ops, Respiratory failure

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Early Extubation 2010

Exclusion Criteria; Re-ops, Respiratory failure

The results shown here are specific to one health care facility and may differ from those achieved by other institutions.
Early Extubation 2011

The results shown here are specific to one health care facility and may differ from those achieved by other institutions.
Impact of POCT

• Reduced drug costs per patient:
  • This has been evaluated by comparing 2009 to 2010 data
  • The results show that there was an increase in patient complexity over the time period looked at

• Integrated cardiac surgery critical care:
  • This results from the fact that all the key clinical personnel are utilizing POCT in various forms, namely:
    • Intensivists
    • Anesthesiologists
    • Respiratory Therapists
    • Perfusionists
    • CCRN’s
  • Hence, knowledge enters the collective of all personnel involved in direct patient care

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## New York Methodist Cardiac Surgery
### 2010 Program Outcomes – NY State Data

#### Volume by Procedure

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>CABG</th>
<th>Valve</th>
<th>CABG/Valve</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>183</td>
<td>101</td>
<td>48</td>
<td>25</td>
<td>9</td>
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<tr>
<td>2009</td>
<td>277</td>
<td>113</td>
<td>40</td>
<td>16</td>
<td>8</td>
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</table>

#### Mortality by Procedure

<table>
<thead>
<tr>
<th></th>
<th>Total # (%)</th>
<th>CABG</th>
<th>Valve</th>
<th>CABG/Valve</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>5 (2.7)</td>
<td>1(1.0)</td>
<td>1 (2.1)</td>
<td>1 (4.0)</td>
<td>2 (22.2)</td>
</tr>
<tr>
<td>2009</td>
<td>5 (2.8)</td>
<td>1(0.9)</td>
<td>2 (5.0)</td>
<td>1 (6.3)</td>
<td>1 (11.1)</td>
</tr>
</tbody>
</table>

#### Morbidity by Procedure (2010)

<table>
<thead>
<tr>
<th></th>
<th>Total # (%)</th>
<th>CABG</th>
<th>Valve</th>
<th>CABG/Valve</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSWI</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Resp Failure</td>
<td>10 (5.5)</td>
<td>2 (2.0)</td>
<td>2 (4.2)</td>
<td>4 (16.0)</td>
<td>2 (22.0)</td>
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<tr>
<td>Stroke</td>
<td>4 (2.1)</td>
<td>1 (1.0)</td>
<td>1 (2.1)</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Q Wave MI</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Reop Bleed</td>
<td>6 (3.3)</td>
<td>3 (3.0)</td>
<td>1 (2.1)</td>
<td>1 (4.0)</td>
<td>1 (11.0)</td>
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<tr>
<td>Renal Failure</td>
<td>2 (1.1)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (22.0)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>1 (0.6)</td>
<td>1 (1.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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#### Quality and Cost Indicators

<table>
<thead>
<tr>
<th></th>
<th>Total Cases</th>
<th>CMI* (Medicare)</th>
<th>PRBC Use (Units)</th>
<th>CTICU Rx** Total Costs</th>
<th>CTICU Rx Cost per pt</th>
<th>LOS*** Variance (days)</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>183</td>
<td>6.04</td>
<td>397</td>
<td>$413,163.68</td>
<td>$2,309.29</td>
<td>1.65</td>
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<tr>
<td>2009</td>
<td>177</td>
<td>5.84</td>
<td>618</td>
<td>$784,887.16</td>
<td>$4,242.63</td>
<td>2.97</td>
</tr>
</tbody>
</table>

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*Medicare Case Mix Index

** >95% of patients stay in CTICU until hospital discharge

***Risk adjusted observed – expected LOS for Q's 1-3

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Catheter Associated Urinary Tract Infections (CAUTI) – All Critical Care Units

SIR (Standardized Infection Ratio) is a summary measure used to compare the hospital acquired infection experience among one or more groups of patients to that of a standard population’s (e.g. National Healthcare Safety Network [NHSN]). Less than 1 means the actual or observed infections is less than expected.

<table>
<thead>
<tr>
<th>Year</th>
<th>NYP SIR Goal</th>
<th>Critical Care SIR</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.32</td>
<td>1.663</td>
</tr>
<tr>
<td>2015</td>
<td>0.32</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>0.32</td>
<td>0</td>
</tr>
<tr>
<td>2017*</td>
<td>0.97</td>
<td>0.277</td>
</tr>
</tbody>
</table>

* Up to Quarter 3 of 2017

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Central Line Associated Blood Stream Infection (CLABSI) – All Critical Care Units

**SIR (Standardized Infection Ratio)** is a summary measure used to compare the hospital acquired infection experience among one or more groups of patients to that of a standard population’s (e.g. National Healthcare Safety Network [NHSN]). Less than 1 means the actual or observed infections is less than expected.

### Yearly Infections

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYP SIR Goal</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.98</td>
</tr>
<tr>
<td>Critical Care SIR</td>
<td>0.339</td>
<td>0.55</td>
<td>0.08</td>
<td>0.133</td>
</tr>
</tbody>
</table>

* Up to Quarter 3 of 2017
Thank you!